

Sustainable energy in UK housing – Monitoring & targeting using integrated datasets

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Abstract

Analysis of the penetration of sustainable energy technologies in UK housing is generally derived from sample survey data. Whilst being extremely useful, these are of limited benefit for those involved in the evaluation, monitoring and targeting activity at a regional or local level.

To address this, The Energy Saving Trust, with funding from UK governments has developed the Homes Energy Efficiency Database (HEED). HEED integrates and stores installations and survey data from a wide variety of sources. This allows national, regional and local analyses of measure uptake, remaining potential and energy/carbon savings to be made. The key programme objectives are:

- To facilitate the assessment of the penetration of sustainable energy measures, over time and by location. Allowing analysis of the overall UK situation, as well as that of constituent nations and other regional/local areas.
- To provide a key source of information to assist local administrations and central government, in monitoring and reporting on their sustainable energy & housing duties.
- To provide a means of assessing the future potential for sustainable energy measures and to facilitate improved targeting, uptake and cost effectiveness.

The database stores data at individual property level to eliminate the potential for “double counting” of measure or survey

data and is date stamped as to when the measure was installed or survey undertaken.

This paper will detail how the project has developed, the challenges faced and how they were overcome and explores the future plans as to how the database will be used to assist the development, implementation and monitoring of sustainable energy activities at a variety of levels.

Introduction

Currently, the penetration of sustainable energy measures and the energy efficiency of the UK housing stock is derived from the extrapolation of sample surveys of properties to the total stock. Historically, these surveys were undertaken every 5 years, though now, some have moved to an annual cycle. For example, the English House Condition Survey (EHCS) now assesses approximately 8,000 dwellings annually, and utilises 2 years of fieldwork for each report [1]. This represents around 0.07 % of the total stock in England. These surveys provide immensely valuable data and analysis. However, now that the survey has moved to a continuous annual survey, output data is currently limited to “Broad Regional Areas” which are amalgamations of around three NUTS¹ Level 1 or Government Office Region (GOR) areas. While such surveys are useful at providing data at regional level they are of limited use at a more local level such

1. Nomenclature of Units for Territorial Statistics (NUTS) / Local Administrative Units (LAUs). NUTS was created by the European Office for Statistics (Eurostat) as a single hierarchical classification of spatial units used for statistical production across the European Union. At the top of the hierarchy are the individual member states of the EU: below that are levels 1 to 3, then LAU levels 1 and 2. <http://www.statistics.gov.uk/geography/nuts.asp>

as Local Authority/District or Electoral Ward (Local Administrative Units (LAU) levels 1 and 2 respectively). Data do exist (albeit on a fragmented basis) that record, often at individual property level, the status of energy efficiency measures in the housing stock. Therefore, while there is a broad understanding at a macro level of the energy efficiency of the UK housing stock; there is no ability to co-ordinate knowledge and information at the micro level and link this to activity or the wider UK context.

Added to the difficulties of ascertaining information on local potential for energy efficiency, there is also the issue of regional monitoring of the programmes and policies in place across the country. While this is not a specific evaluation task for EST, such knowledge is valuable in assisting EST's own evaluation activity as well as providing an evidence base to assist in policy development both for EST and our Government funders.

Within the United Kingdom there is a myriad of activity aimed at improving domestic energy efficiency; two of the main initiatives are the Energy Efficiency Commitment or EEC [2] and the UK Governments' schemes to help combat fuel poverty. The Energy Efficiency Commitment is an obligation to meet a pre-defined energy saving target placed on gas and electricity suppliers in Great Britain who have more than 50,000 domestic customers. In Northern Ireland a levy scheme operates with the sole electricity supplier in a broadly similar way.

The other main initiative for improving levels of domestic energy efficiency are the programmes funded by the UK Governments to combat fuel poverty through the installation of insulation measures and heating systems. The largest of these schemes, Warm Front, has been operating in England since June 2000 [3]. To date it is estimated to have assisted over one million households [4].

There are many other policies and initiatives in operation within the UK ranging from: the Building Regulations; information, advice and grant programmes run by organisations such as the Energy Saving Trust; as well as activity at district level from local authorities. Local authority energy efficiency activity mainly exists as a result of local housing and fuel poverty strategies and the legislative driver of the Home Energy Conservation Act 1995 (HECA) [5]. This requires every UK local authority with housing responsibilities to prepare, publish and submit to the Government an energy conservation report identifying practicable and cost-effective measures to significantly improve the energy efficiency of all residential accommodation in their area; and to report on progress made in implementing the measures. At present, in England it is very difficult to compare local authorities' performance as there is no prescribed method for all authorities to follow when submitting their return. All that is required is that a HECA officer uses an agreed method and is consistent in this.

It was upon this backdrop that EST commenced the development of the Homes Energy Efficiency Database (HEED) in 2001. The aim was to develop an information resource that builds upon the discrete datasets that exist amongst the key actors within the UK energy efficiency sector into one comprehensive and integrated system. This resource would, for the first time, provide the ability to assess the impacts of the whole spectrum of UK policies and initiatives at both a national and local level. The funding for the development work for the project

is being provided by the Department of Environment, Food and Rural Affairs (DEFRA) as well as the Scottish Executive. The first phase of the database was released to users during the summer of 2005. The remainder of this paper will detail how the database was developed, how it is being used and how this will develop in the future.

Database Infrastructure

INTRODUCTION

The Homes Energy Efficiency Database operates on the Oracle 10g enterprise platform on servers running Red Hat Linux as an operating system. It is a fully relational database comprising of 65 tables and 13 materialised views. Database size at present is approximately 36 GB of data.

Reports are available in spreadsheet, HTML and Adobe Acrobat pdf format and are accessed from a web based reporting application called HEED Online. This has been written in Java and is deployed on an Oracle 10g application server. It is also possible to view the data geographically with Geographic Information System (GIS) based mapping data and rendered using Oracle MapViewer.

Users do not access the HEED database directly but run reports from the web based application called HEED Online (<http://www.est.org.uk/heedonline>). Access is by username and password which provides users with access to specific geographic areas. Users select the type of report required (survey information, installations or savings) then select which geographic area they are interested in. For example, a local authority user will have access to data on their own local authority area (LAU level1) down to electoral ward (LAU 2) level. Users such as EEC-obligated energy suppliers can view the whole of Great Britain to electoral ward level.

The database records property survey attributes and other sustainable energy information against known property references. Data is stored at individual address level to avoid the "double counting" of data relating to the same property or improvement that could be received from different data sources. HEED also maintains a history of improvements. When a dwelling receives an improvement or new or more accurate data is received, the previous data is recorded in a mirror image of the main database table. In this way it is possible to track the energy improvement of a dwelling over time.

DATA TYPES – SURVEY DATA

Data for HEED is obtained from a number of different sources and exists as 2 main types, survey or measure installations. Survey data provides the database with the base information regarding the property details, building fabric and heating fuel(s) of the dwellings. Table 1 provides examples of the property attributes that can be recorded.

It is important to note that not all the available attributes may be available and hence recorded for a dwelling. However, HEED has been designed so as to accept as much or as little data as is available yet still ensuring that the reports can be run and give valid results even without a complete survey data set for a particular dwelling.

Property survey data for HEED can be collected from a number of sources:

Table 1. Property survey data types and examples

Data type	Examples
Property type/built form & no. bedrooms	Flat, Detached House, Mid-terraced house etc
Construction date	Before 1900, 1900-1929, 1930-1949, 1950-1965, 1966-1976, 1977-1981, 1982-1990, 1991-1995, 1996 or later
Property tenure	Owner occupied, private rented, local authority, registered social landlord.
Heating fuel	Natural gas, electricity, oil, LPG etc
Main heating system	Boiler with radiators, storage heaters, room heaters
Heating controls	Room thermostat, cylinder thermostat, TRVs, automatic charge control
Boiler type	Condensing, non-condensing, combination, back
External wall type	Cavity, filled cavity, solid, stone, timber frame
Loft Insulation	None, 1-24mm, 25-49mm, 50-74mm etc.
Window type	Single, double, wooden frames, uPVC frames, metal frames
Hot water heating system	From main heating system, single immersion, dual immersion, instantaneous etc.
Hot water tank insulation	Factory fit, good jacket, poor jacket, no insulation, no HWT
Energy rating	SAP, RD-SAP, NHER

EST Home Energy Checks (HECs)

The Energy Saving Trust supports a network of 46 Energy Efficiency Advice Centres (EEACs) and three pilot Sustainable Energy Centres (SECs). These are located across the United Kingdom and give impartial advice to householders about saving energy in the home (wider sustainable energy advice incorporating energy efficiency, microgeneration and cleaner transport, is available from the SECs). One of the main mechanisms for giving this advice is the Home Energy Check or HEC. This is a householder completed questionnaire containing thirty three questions about the dwelling and its energy efficiency attributes. This data is then fed through an advice database and a unique advice report is generated on the basis of the responses. The HEC has evolved over the years and the advice database now undertakes an energy calculation based on the BREDEM (Building Research Establishment Domestic Energy Model) which gives detailed estimates of running costs and possible improvements based on the unique characteristics and location of the dwelling. Since 1999 there have been some 4 million HECs completed. These have all been loaded into HEED. Typically some 500,000 HECs are completed each year either through EEAC activity or online via the EST's website. These Home Energy Checks are uploaded onto HEED on a regular basis and at present make up a significant proportion of the base data stored within HEED.

Government Fuel Poverty scheme data (e.g. Warm Front)

The Government fuel poverty schemes such as Warm Front in England, New HEES in Wales and Warm Homes in Northern Ireland² provide extremely valuable data. These sources provide both detailed survey information on dwellings as well as details of energy efficiency measures subsequently installed as a result of the survey. These fuel poverty surveys typically provide around 17 different data attributes ranging from the property type, size and tenure to the state of the building fabric and heating systems. The fuel poverty schemes in England, Wales and Northern Ireland are currently all managed by one scheme manager, Eaga Partnership. This makes data loading straightforward as the data is all in the same format.

Local authority data

A relatively small amount of the survey data currently available for inclusion in HEED is sourced from Local Authorities. This data is typically collected by local authority surveyors as part of local house condition surveys. Occasionally this data can be householder completed energy surveys similar to EST Home Energy Checks. This data can vary in its complexity, ranging simply from an address list detailing the tenure or property type to a full set of survey information.

2. Warm Homes and Central Heating Programme are the Scottish fuel poverty programmes. However, at the time of writing, final approval to access this data from the Scottish Executive is still outstanding.

Table 2. Sustainable energy measures capable of being stored within HEED.

Wall insulation	Heating controls
Loft insulation (various thicknesses)	Compact fluorescent lamps (various wattages & lifetimes)
Draught proofing	Energy efficient white goods (various)
Hot water tank insulation	Solar PV systems
Central heating boilers	Solar thermal systems
Electric storage heaters	Ground/air source heat pump
Room heaters	Micro CHP
Solid fuel fire cassettes	Micro wind turbines

Social Housing data

Data from social housing providers such as local authorities and registered social landlords is also available to HEED. Currently, the main source of this data is NROSH, the National Register of Social Housing³. This is a central property database of social housing properties in England operated by the Department of Communities and Local Government.

DATA TYPES –INSTALLATIONS DATA

The other main data type stored in HEED is installations data. This relates to the physical sustainable energy measures have been installed, when and by whom. HEED can accommodate a wide variety of different measures, certainly all that are currently offered to householders. It is a straightforward task to add a measure not currently listed. Examples of the kinds of measures that can be registered in HEED are given in Table 2.

Once again a number of different sources provide access to installations data. These are examined below.

Energy Supplier data

The main delivery mechanism for the installation of energy efficiency measures in the United Kingdom is that of the work funded/part funded by energy suppliers as part of their energy efficiency obligations. In Great Britain, there have been energy supplier energy efficiency obligations in place since the Energy Efficiency Standards of Performance (EESoP) 1 scheme which started in 1994. At present the Energy Efficiency Commitment 2005-08 (EEC2) scheme is expected to save 122 TWh of energy and deliver an annual carbon saving of around 0.7 MtC in 2010. This obligation falls on all gas and electricity suppliers in Great Britain who have more than 50,000 domestic customers. There is flexibility as to how they targets are achieved, although at least 50 % of the savings must be achieved in the 'Priority Group', those households who are in receipt of certain income related benefits and tax credits. Data from the Energy Efficiency Commitment will generally provide details of what measures have been installed together with the installation date as well as some basic property survey information. This typically covers the property type, number of bedrooms, tenure and heating fuel. The last completed scheme, EEC 2002-05 delivered in excess of 1.6 million fabric insulation measures, 400,000 heating systems, 6.5 million energy efficient appliances and 40 million CFLs [2].

The priority data from GB energy suppliers is the data from the EEC1 scheme going forward. However, where data is available from the energy suppliers from their activities undertaken previously, particularly insulation this will be included in the database should it become available.

Data from activity in Northern Ireland is similar in content but relates to the Northern Ireland Energy Efficiency Levy scheme. This was introduced as part of a review of the price controls on Northern Ireland Electricity plc (NIE) by the energy regulator Ofgem in 1997/98. Since that time some 53,000 insulation and 12,000 heating measures have been installed as a result of the levy scheme.

One of the major challenges facing the HEED project was securing the participation of energy suppliers who have no obligation to supply data on their activity to the database. Whilst the suppliers' are keen on HEED and how it could assist them to deliver their targets, significant barriers to securing their participation had to be overcome. These barriers were principally issues surrounding the UK's Data Protection legislation as well as issues surrounding commercial confidentiality. Due to these concerns and their complexity, it has taken approximately 4 years effort to secure the agreement of suppliers to provide their data to the project on a voluntary basis. This was achieved through significant negotiations with operational and legal teams together with the development of legal agreements to define permitted use of data and terms of access.

Cavity Insulation Guarantee Agency data

CIGA was created in 1995 by the insulation industry in consultation with the UK Government as an independent agency to provide and administer a 25 year guarantee covering retrofit installations of cavity wall insulation and technical leadership to the industry. Since that time, in excess of 2 million guarantees have been issued and provision of an independent CIGA Guarantee is a requirement of all Government grant schemes and the Energy Efficiency Commitment, so almost 100 % of all installations are covered.

Data from CIGA informs HEED the details of which properties have had cavity wall insulation installed and when the work was completed. This source however is unable to provide further details of the property except sometimes the tenure. It does though represent an important corroborative data set as it complements installations data from both the energy suppliers' activity and the Governments fuel poverty programmes.

3. National Register of Social Housing (NROSH) <http://www.communities.gov.uk/index.asp?id=115668>

Energy Saving Trust data

The Energy Saving Trust, since it was created by the UK Government in 1993, has managed a number of grant programmes ranging from insulation and condensing boiler grants in the late 1990s to local authority support grants and microgeneration programmes at present. Over that time over 110,000 grants to provide cavity wall insulation were provided as well as over 15,000 condensing boiler grants. More recently, funding has been made available to over 100 local authority groups via the Innovation programme as well as householders to assist the installation of microgeneration technologies. In the case of the Innovation programme, this data is collected using a bespoke data collection tool called HEEData Online.

CALCULATION ENGINE

One of the advantages of HEED is that it is possible to calculate energy and carbon savings for measures installed across a range of mechanisms using a consistent set of savings and assumptions. These savings are calculated using a calculation engine, at the heart of which are the ex-post savings that are used to evaluate the impact of the Energy Efficiency Commitment. Details of these savings and the assumptions behind them can be found by consulting the Energy Efficiency Commitment 2005-08 Technical Guidance Manual [6] and associated spreadsheets [7]. These savings were modelled by the Building Research Establishment using the BREDEM-12 model [8]. This is a two zone domestic energy model which uses a combination of analytical and empirical techniques. An analytical approach, involving balancing heat losses (system, fabric and ventilation) against a variety of gains, to calculate the space heating energy requirements. Empirical functions are then used to estimate the utilisation of gains, the demand for hot water and the energy use for cooking, lights and appliances. The energy requirements of standard dwelling types are modelled for a range fabric insulation and heating systems to derive energy and carbon savings for a range of improvement measures. The engine uses property type and size information together with heating fuel and measure detail to apply the appropriate modelled saving of annual and lifetime energy, carbon and associated customer benefits. The assumptions used by the regulator Ofgem to evaluate the EEC in terms of rebound/comfort factors and energy prices and carbon factors are also used.

DATA CONFLICTS

One of the major challenges of developing such a database and trying to integrate data from a variety of different sources is that data conflicts can occur. These conflicts can arise when data from different sources detailing the same dwelling is loaded and conflict with each other. When this occurs the database must be told which data to accept as valid and which to discard. This must also be balanced with the basic premise of data collection within HEED; that the most recent information is stored and made available. However, this also must also take into account the accuracy of the data being collected.

In order to address this issue of conflicting data, a set of complex and detailed programming has been developed. This coding, called Auto Conflict Resolution (ACR) deals with this problem by examining both the sources of the data involved in the conflict and the age or detail dates (survey date or measure installation date) of the data.

Prior to a data set being loaded into the database, the source of the data is allocated a 'trust level' or hierarchy. This is a measure of how accurate the data is deemed to be. For example, data supplied by an energy supplier or Government fuel poverty scheme managing agent, is deemed high trust as the information is collected by trained surveyors. In contrast, from experience the data sourced from householder completed Home Energy Checks and other similar surveys are allocated a low trust level. This is due to the fact that householders are more likely to make mistakes in identifying property characteristics such as external wall type and loft insulation thickness.

As the database is still fairly new and coverage relatively low, the majority of data received refers to dwellings that do not have an existing reference in the database. In this case, the data is loaded regardless of trust level as there is no existing data to contradict what has been received. Should a conflict occur during the load process, the Auto Conflict Resolution package activates. Firstly the dates (survey or installation date) and trust levels of both data are determined. Should the data being loaded be newer and hence more up to date than the existing data already stored in the database, the existing data will be overwritten and stored in the history table. The newer data will be loaded into the 'live' tables and used in reporting. If on the other hand the data being loaded is older than what is currently held, this data when fully loaded will be stored in 'history' and not used in live reporting.

The second stage of the ACR is activated whenever the conflict involves one of the following dwelling attributes:-

- Property type
- Tenure
- Loft insulation
- Wall type and insulation
- Heating system

If any of these attributes are conflicting, then the trust levels of both data are examined and the data with the highest trust is stored and the lower trust data discarded and placed in 'history'. For example, data is newly received from a low trust source such as householder completed Home Energy Check; this is newer than the data currently existing for the address already in HEED. It indicates that the dwelling is a detached house with 5 bedrooms, solid external walls, 200mm of loft insulation and a standard gas boiler. Records already exist for the same address in the database from an EEC energy supplier scheme (a higher trusted source). This reports that the dwelling is a detached house with four bedrooms; the cavity walls have been filled by the energy supplier who also installed a condensing boiler. In this case the number of bedrooms for the property will be updated, the property type and levels of loft insulation will remain the same, but the newer data on the external wall type and heating system will be rejected and the existing data from the energy supplier retained. By using this methodology, the key data within the database is always kept as accurate as possible.

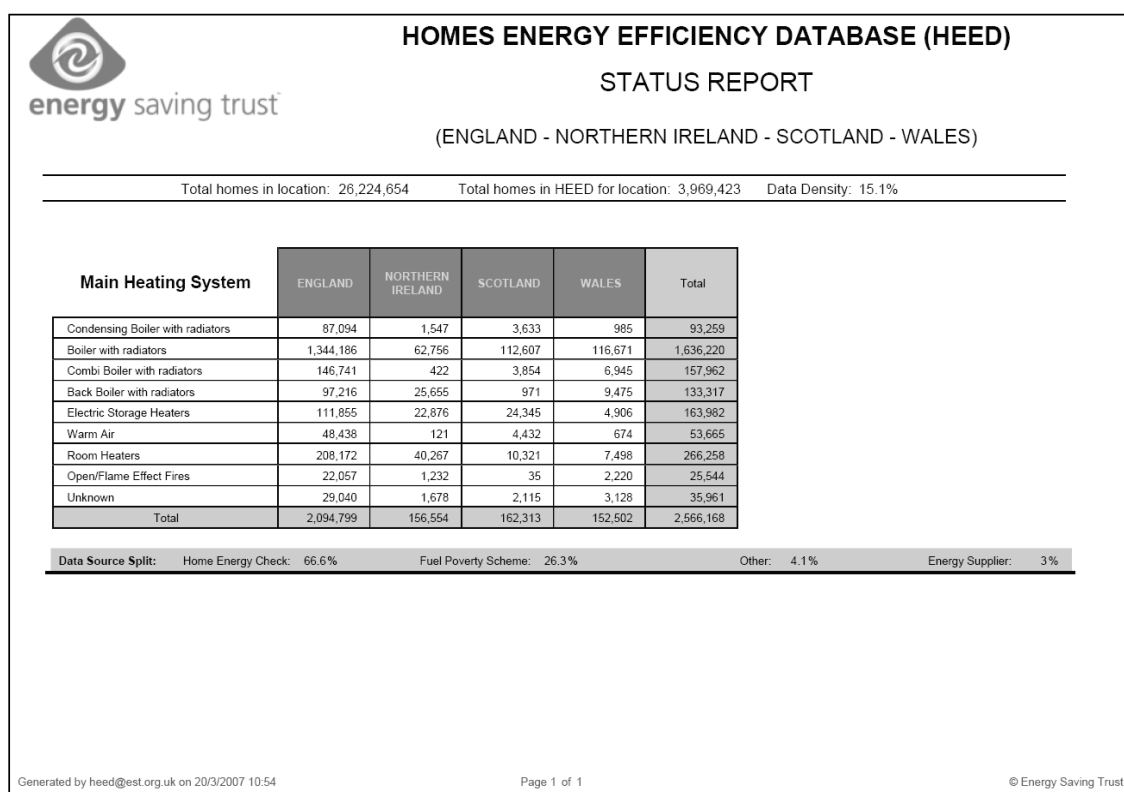


Figure 1. An example of Status Report comparing heating systems across the constituent nations of the UK.

DATA FORMATS

Another significant challenge when embarking on a data integration project is in the format of the raw data received that must be manipulated and incorporated. HEED integrates data from a wide variety of sources, unfortunately all of these sources store and provide data in different ways. Data is loaded into HEED electronically from comma separated variable (.csv) text files. The structure and format of these files though differs from source to source. There are currently at least 13 different data formats for raw data. Understandably, this presents the IT development team with a considerable challenge.

The structure of the database and the attribute types within it, have been designed from the outset to be as flexible as possible, where feasible matching the attributes used by the main data sources. We are confident that data from any source could be successfully loaded as long as a valid UK address is provided for each dwelling. The addresses themselves are matched against a central database provided by the Royal Mail which is updated on a monthly basis.

In order to assist sources such as local authorities to provide data, a data capture tool called HEEData Online has been developed. This application enables users to input data either by manual entry or via electronic batch import, over the internet into a dedicated and secure database where property and measure installations data can be recorded. This provides users with a resource where they can keep track of their own activity both in terms of dwellings improved and savings made. The data is stored in a consistent format so that its inclusion into HEED is made significantly easier. HEEData is only used at present as part of the EST Innovation grant programme, but it could be made available to other potential users during 2007-08.

REPORTING OUTPUTS

There are currently two main types of report available from HEED; textual/numerical and graphical. Both are selected by using the HEED Online web application.

Textual/Numerical Reports

These reports are available in spreadsheet, HTML and pdf format. The following types are currently available:

- Area Summary – housing stock summaries detailing property type, tenure, fabric insulation levels, heating fuels & systems and average gas & electricity consumption & CO₂ emissions.
- Status – detailed analysis of fabric insulation, glazing & heating by property type tenure and location
- Installation summary – details of measures installed
- Insulation targeting – priority ranking of localities based on available potential for insulation measures
- Savings – energy, carbon and financial savings (annual & lifetime)

The user firstly selects the theme for the report and then the geographic area of interest and report title. If required, the user can apply a range of filter options such as property type, property age, tenure and heating fuel. Lastly, a date range can be added to further refine the filter for installation and savings reports. An illustration of the level of data coverage (data density) within HEED for the area in question is also provided.

One of the major developments during 2006-07 was the development of the Area Summary Report which provides a snapshot of a given area of the country. This details key at-

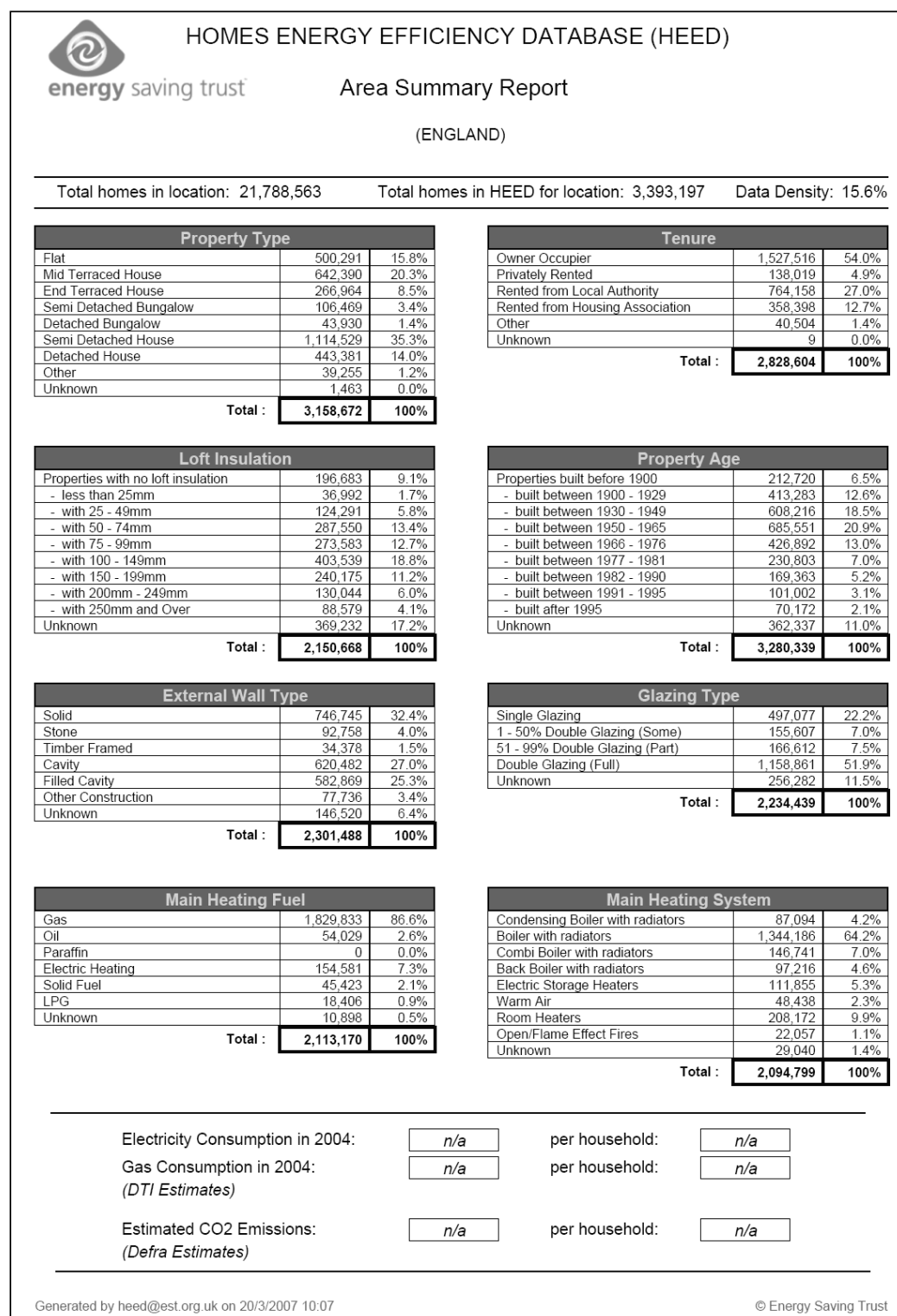


Figure 2. Area Summary Report detailing England

tributes such as the property type, age and tenure of properties together with details of the building fabric, insulation and heating systems. Also included in the report is data from the Department of Trade & Industry (DTI) detailing regional gas and electricity consumption as well as estimates of domestic CO₂ emissions produced by DEFRA. An example of an Area Summary Report is provided in Figure 2.

Graphical Reports

While the textual reports provide a great deal of detail, it can be difficult to fully appreciate what is actually being displayed, simply due to the vast array of detail displayed on the page. To assist in the interpretation of the data, a geographic based graphical interface has been developed using electronic mapping data provided by both the Great Britain and Northern Ireland Ordnance Survey. This enables users to visualise the

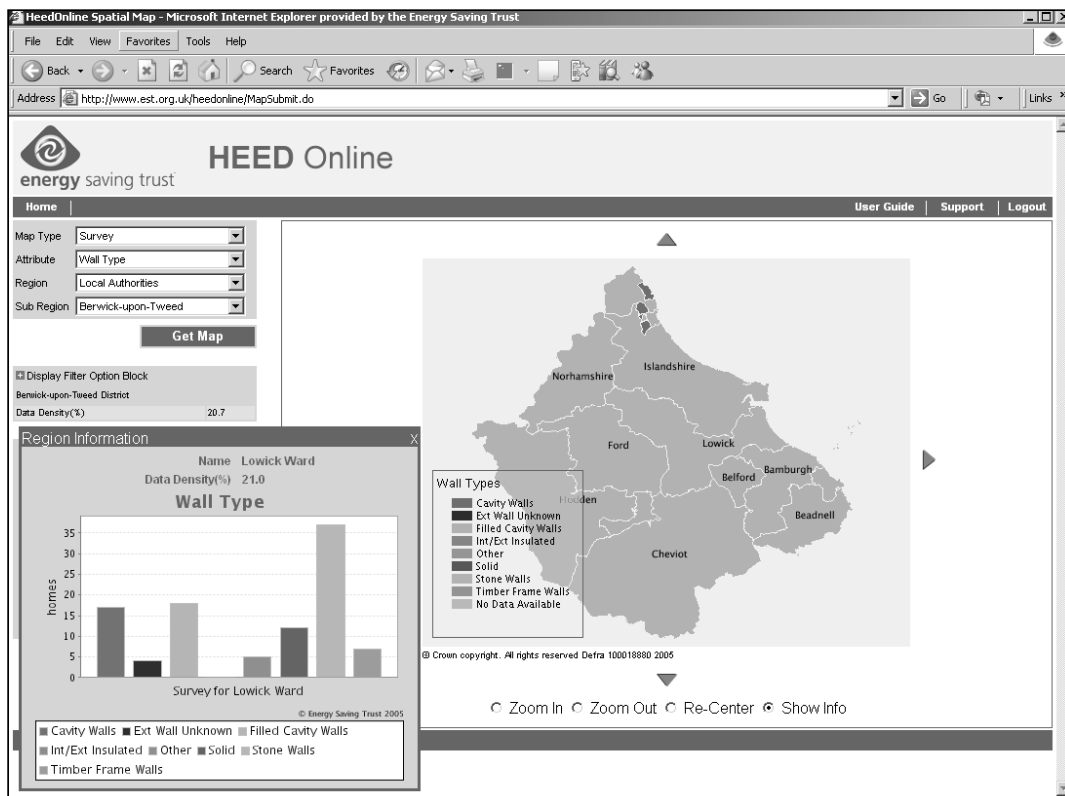


Figure 3. External wall type by ward within Berwick-upon-Tweed

data in a Geographic Information System (GIS) as it is superimposed onto administrative boundary maps.

At present only survey maps are available, but maps comparing energy and carbon savings are being developed. A wide variety of dwelling attributes can be examined including: property type, tenure, age, external wall type, loft insulation, main heating system, fuel and glazing. It is also possible to apply filters such as tenure, age and fuel in a similar way to the textual based reports.

These maps show the most common variable for each attribute for a given area. In order to gain an appreciation of the distribution of a particular attribute further data is also available. This is illustrated in Figure 3 below which shows external wall type for the electoral wards within Berwick-upon-Tweed Borough Council in Northern England. Also shown, is the distribution of wall types within a particular ward. This chart assists users in understanding the distribution of a particular attribute as the system shows the most prevalent attribute by default. Other information including data density (the coverage of dwellings in the area) as well as energy/carbon savings and summaries of the numbers of energy saving measures installed are also available.

Current Status

The Homes Energy Efficiency Database was released to users during the summer of 2005, since that time over 170 users have registered with EST and have access. The majority of these users are local authority officers with Home Energy Conservation Act (HECA) responsibilities. Other users, external to EST include energy suppliers, government departments, the EST Advice Network and Universities.

DATA SOURCES AND COVERAGE

At the time of writing, HEED contains approximately 41 million individual data items describing some 4 million homes across the United Kingdom. This approximates to around 16 % of the UK housing stock. The majority of this data is sourced from EST Home Energy Checks as well as data from the Government fuel poverty schemes in England and Wales. It is estimated that EST holds details of a further 2 million homes that have yet to be loaded. This data consists of some further updates to Government fuel poverty programmes, EST Home Energy Checks, CIGA guarantee data, EST grant funded installations and energy supplier activity during EEC 2002-05. Work is ongoing to clear this backlog.

CURRENT ACTIVITY

The database is still relatively new and in its early stages of use. Coverage across the United Kingdom is variable with some areas having data densities of as much as 40 % whereas others may be at only a few percent. This should, though, be taken in context with both national and local stock condition surveys, where samples are typically around 1 % or lower. Nevertheless, the database is being used particularly as a tool to assist in the targeting of Energy Efficiency Commitment activity by some energy suppliers as well as local monitoring by local authority officers. EST is also using HEED to assist in the planning of marketing activity at a more regional level and to assist in programme evaluation.

2006-07 has been a year of consolidation for HEED. The main focus of activity has been clearing the backlog of data and widening coverage. Improvements to functionality have also been made by expanding the suite of reports available and improving the user experience by enabling multiple reports to

be generated simultaneously and the ability to save 'favourite' reports so that users can rapidly access the data they require.

Northern Ireland version

One of the most important developments during early 2007 was to complete the development of a specific version of the database and web application for users in Northern Ireland. Currently, the lowest level of reporting aggregation is electoral ward (LAU2) which typically covers a few thousand homes. This limitation is a condition placed on EST by the EEC-obligated energy suppliers in Great Britain and was a condition of their participation in the project. Whilst ward level data is very useful in terms of identifying potential and targeting activity it would be possible to obtain a greater level of resolution by reporting using different geographies. The UK Census which was last held in 2001 revealed data at a new level of geographic output called Output Areas (OA)⁴. These areas typically cover around 125 households and would therefore provide greater focus on local data. Another local geography in the UK is the postcode and is used to identify postal delivery areas⁵. Typically a full postcode, for example SW1H 9BP if in a residential area would usually cover 15-25 individual postal addresses.

As the EEC-obligated suppliers do not operate in Northern Ireland, EST has chosen to develop a pilot version of the database that allows sub-ward reporting at both output area and postcode. EST is working with a range of partners in the Province to help target improvement activity, particularly with regard to improving loft insulation. Northern Ireland offers a unique environment for partnership working with a sole HECA authority, a single electricity supplier and two gas suppliers together with an EST Advice Centre. The pilot programme will be launched in April 2007 and it is hoped that following a successful demonstration it could be adopted (with GB energy supplier agreement) across the rest of United Kingdom making HEED even more powerful as a targeting tool.

EST consumer segmentation

Another recently completed development is the integration of the EST Consumer Segmentation within HEED. This segmentation of UK households was undertaken by the EST marketing function to help determine the most appropriate messages, communication channels and products to reach and influence their target audiences. A third party segmentation called Mosaic was chosen to form the basis of the EST model. Mosaic is a consumer segmentation model developed by Experian for all UK residents. It consists of 61 types which are grouped into 11 segments based on demographic profiles (age, gender, education, income, etc). It is also geo-demographic as it is linked to household postcodes. Energy consumption data together with a range of attitudinal data was overlaid across the Experian Mosaic model creating a composite segmentation which divides UK households into 10 segments each with a different propensity and potential to save carbon. From these 10 segments, EST has selected 4 where it is believed the greatest carbon savings can be achieved through targeted marketing activities. It is now

possible to use HEED with this segmentation to match areas which offer the greatest potential for individual measures with those householders within the segments most likely to take action when prompted. This functionality has only just become available, but will be crucial in ensuring EST's marketing activity is appropriately targeted and cost effective.

Regional Monitoring Strategies

With its greater coverage of the housing stock and wide dataset, HEED now has the potential to assist local and regional administrations with the development, monitoring and evaluation of sustainable energy strategies. A series of workshops are planned during 2007-08 to work with key individuals at a regional level to help them make full use of the system. There has also been interest from a number of users with reference to standardising the performance monitoring as required by the Home Energy Conservation Act 1995 within England. As has been described earlier there is no standard methodology for HECA reporting in England. It has been suggested by many local authority users, that the logical progression for HEED in future will be to undertake this reporting centrally. In its current form; HEED is a tool to assist in this but is not in a position to take this role over fully. A review of HECA has recently been completed by Defra and the results are eagerly anticipated, though it is thought to be more likely that HEED would have a more formal supporting role rather than being the main method for reporting progress

EVALUATION RESULTS

During early 2006, the EST's Evaluation Department who provide independent monitoring and evaluation of EST's programmes completed an initial evaluation of the HEED project [8]. This entailed interviewing a range of HEED users from a variety of organisations and user groups. The findings can be summarised as follows:-

- Overall HEED is an innovative and positive step towards developing a comprehensive tool which facilitates monitoring, reporting and targeting for the EE domestic sector.
- HEED successfully pulls together discrete data into one database; where data can be stored, retained and accessed effectively.
- HEED has started to improve the ability to target areas with the greatest potential for carbon savings at the local level.
- HEED has created the opportunity for new areas of work to be undertaken that have previously been very difficult. This includes setting targets and monitoring progress with regional strategic work and more accurate and focused targeting.
- The current level of data coverage (on a UK wide basis) is viewed as too low for the outputs to be crucially valuable to users, so not all expected benefits have been realised.

These results are encouraging and very useful. Based on these findings and recommendations significant further work has been undertaken in the past year to make the database crucially valuable through the data loading activity and new development work. With data coverage now in the region of 20 %, it

4. Further information on census geography can be found at <http://www.statistics.gov.uk/census2001/op12.asp>.

5. Further information on postal geography can be found at http://www.statistics.gov.uk/geography/postal_geog.asp#ps.

will be interesting when further evaluation activity is undertaken during 2007-08.

Future plans

ENERGY PERFORMANCE CERTIFICATE DATA

In terms of future data sources, the introduction of Energy Performance Certificates (EPC) as part of the implementation of the Energy Performance in Buildings Directive is the most important in its potential. In the residential sector these will be required whenever a property changes occupier, either through a sale/purchase or a change in tenancy for rented properties. The EPC will provide prospective occupiers with information as to how energy efficient the dwelling is and will also make recommendations as to cost effective improvements to improve energy performance. In England and Wales, EPCs are mandatory on house sales from June 2007. Implementation will be later in Scotland and Northern Ireland. EST has made representations to both Defra and the Department of Communities and Local Government (CLG) to access data from EPCs issued in England and Wales. However, CLG had announced in 2006 that this data would not be forthcoming. Since that time discussions have continued and we remain hopeful that this disappointing decision will be reversed and the opportunity to identify and improve dwellings with poor energy performance will not be lost.

EST is also in discussions with the Scottish Building Standards Agency as well as the Northern Ireland Department of Social Development regarding access to EPC data for homes in Scotland and Northern Ireland. The outlook is much more positive for these nations and at the time of writing it is believed that HEED may play a significant role in the storage of EPC data on behalf of the Scottish Building Standards Agency and Scottish Executive.

MICROGENERATION

HEED has been expanded to include the details of microgeneration technologies such as photovoltaics, solar thermal, wind turbines and heat pumps. These additions mean that HEED is now a sustainable energy database instead of just one detailing insulation fabric, heating and other energy efficiency measures. Microgeneration technologies are still niche rather than mainstream in the UK. In order to help market transformation, a range support activity has been undertaken and is ongoing. The Department of Trade and Industry (DTI) funds the Low Carbon Buildings Programme⁶, the householder and business streams of which are administered by EST. This is a 3 year scheme which offers a range of grants to incentivise the installation of microgeneration technologies. Approval to access this data has now been received and it will shortly be loaded into HEED together with data from a similar scheme, the Scottish Community Householder Renewables Initiative (SCHRI)⁷. This is a grant scheme funded by the Scottish Executive and administered by EST and Highland & Islands Enterprise to raise awareness of the potential for microgeneration and to

promote their installation in domestic and community buildings in Scotland.

It is hoped that the integration of the microgeneration data will assist the development of these markets by identifying clusters of installations that can assist in installer base or supply chain development (especially with regard to biomass). It is hoped that localised wind speed and solar irradiation data and even dwelling orientation data will be included in HEED so that further potential analysis work can be undertaken.

Conclusion

In the past year the HEED project has made significant progress, important new data sources have been added, new informative reports developed and new capabilities such as the EST consumer segmentation added. Coverage of the UK housing stock has also doubled, enabling HEED to become the most comprehensive database of its kind in the United Kingdom. There is though still much more work to be done if the long term targets of at least 50 % coverage of UK housing stock by 2010 are to be achieved. New data providers must be engaged as partners and increased numbers of local and regional data partnerships must be formed to build on the work to date with the national data sources.

The pilot version shortly to become operational in Northern Ireland offers a significant opportunity to demonstrate the potential of the system and how the use of detailed local data sets from a wide range of sources can be used by a number of partners to improve household energy efficiency. The programme has reached a turning point in terms of data coverage and numbers of users. Initial evaluation work has been encouraging and provides the directions required for further development. HEED may not yet be an indispensable tool to assist in the planning, monitoring and targeting of energy efficiency now, but the challenges of development and stakeholder engagement have been overcome. HEED will be a key tool in assisting EST in programme delivery as well as other stakeholders in the UK sustainable energy arena. The challenge of fully realising the huge potential that HEED offers is the next to be overcome.

References

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